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DEPARTMENT OF COMMERCE

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# RAILROAD FUEL-OIL CONSUMPTION IN 1928

BY

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

# RAILROAD FUEL-OIL CONSUMPTION IN 1928[1]

By Arthur H. Redfield[2]

This study of railroad fuel-oil consumption in 1928 is a continuation of the study of Railroad Fuel-Oil Consumption in 1925, by E. B. Swanson, published in January, 1927, as Information Circular 6017, of the Bureau of Mines; of Railroad Fuel-Oil Consumption in 1926, by A. H. Redfield, published in October, 1927, as Information Circular 6049; and of Railroad Fuel-Oil Consumption in 1927, by A. H. Redfield, published in August, 1928, as Information Circular 6078.

## ACKNOWLEDGMENTS

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## GENERAL STATEMENT

Nearly 600,000 barrels more fuel oil was consumed by United States railroads in 1928 than in 1927. From 67,435,495 barrels in 1927 the use of fuel oil by steam railroads increased 0.9 per cent to 68,028,196 barrels in 1928. Of these totals locomotives consumed 58,694,611 barrels in 1927 and 60,243,115 barrels in 1928, whereas 8,740,884 barrels in 1927 and 7,785,081 barrels in 1928 were consumed in furnaces, forges, shops, and miscellaneous uses. A gain of 1,027,919 barrels in the total railroad consumption of fuel oil in the South Central States more than outweighed reductions of 401,700 barrels in the Atlantic States, of 329,344 barrels in the Rocky Mountain States, and of 17,468 barrels in the North Central States. The net increase of 592,701 barrels in the national consumption was made up in part also by increases of 292,486 barrels in Washington and Oregon and of 20,808 barrels in California.

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[1] - The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6228."

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The causes of these changes in consumption were various and due to local conditions. In the California district an increase in the ton-mileage of revenue-freight hauled and a relative decrease in the use of coal as locomotive fuel were reflected in a greater use of fuel oil in 1928 than in 1927. More coal and less oil was burned by locomotives in the Rocky Mountain and North Central districts. Both freight and passenger traffic fell off considerably in 1928 on the principal oil-burning railroads in the Atlantic States. On the other hand, lower prices stimulated the use of fuel oil on railroads in the South Central States and on railroads terminating in Washington and Oregon. The only nation-wide condition was a tendency to greater economy in the consumption of fuel, both liquid and solid.

Purchases of fuel oil by railroads were 198,938 barrels less in 1928 than in 1927. The carriers bought 68,130,158 barrels in 1927 but only 67,931,220 barrels in 1928. Increases of 638,032 barrels in the fuel oil purchased in the South Central States, of 49,739 barrels in the Oregon-Washington district, and of 35,413 barrels in California were more than offset by decreases amounting to 610,148 barrels in the Atlantic States, to 296,766 barrels in the Rocky Mountain States, and to 15,208 barrels in the North Central States.

Stocks of fuel oil held by the railroads were reduced during 1928 by 96,976 barrels. On January 1 they amounted altogether to 15,928,841 barrels but on December 31, 1928, to only 15,831,865 barrels. The only important increase in stocks was in the South Central States, where 445,419 barrels were added during 1928 to the 9,168,675 barrels held in storage at the beginning of the year. This addition was more than counterbalanced by a decrease of 305,285 barrels in California stocks and of 144,274 barrels in stocks held in the Oregon-Washington district.

Railroad Fuel-Oil Purchases, Stocks, and Consumption, 1928
(In barrels of 42 U.S. gallons)

| | | Stocks | | | |
|---|---|---|---|---|---|
| District | Purchases | January 1[1] | December 31 | Change | Consumption |
| California | 24,311,079 | 5,721,543 | 5,416,258 | -305,285 | 24,616,364 |
| Oregon-Washington | [2]6,077,354 | 546,170 | 401,896 | -144,274 | 6,221,628 |
| Rocky Mountain | 2,144,419 | 100,322 | 116,812 | + 16,490 | 2,127,929 |
| North Central | 175,908 | 13,536 | 16,361 | + 2,825 | 173,083 |
| South Central | 32,622,500 | 9,168,675 | 9,614,094 | +445,419 | 32,177,081 |
| Atlantic | 2,599,960 | 378,595 | 266,444 | -112,151 | 2,712,111 |
| | 67,931,220 | 15,928,841 | 15,831,865 | -96,976 | 68,028,196 |

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1 - Revised.

2 - Of this quantity, 4,460,694 barrels was purchased in California, 1,153,222 barrels in the Rocky Mountain oil field, and the remainder variously from Alberta, the Mid-Continent, and dealers in the North Central States.

As usual, two districts, the California and the South Central, accounted for more than four-fifths (83½ per cent) of the total consumption of fuel oil by railroads. Fully 95 per cent of the whole was consumed west of the Mississippi River. More than half of the total was consumed between the Mississippi River and the Rocky Mountains. The South Central district led in the railroad consumption of fuel oil with about 47 per cent, followed by California with about 36 per cent. A little over 9 per cent was consumed by railroads terminating in Washington and Oregon, and about 4 per cent by railroads terminating in the Atlantic States. Less than 3½ per cent of the total was consumed in the North Central States and in the Rocky Mountain States combined.

Railroad Fuel-Oil Consumption, 1925-1928

(In barrels of 42 U.S.gallons)

| District | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|
| California | 24,563,663 | 24,042,341 | [1]24,595,556 | 24,616,364 |
| Oregon-Washington | 5,291,603 | 5,595,818 | 5,929,142 | 6,221,628 |
| Rocky Mountain | 2,419,729 | 2,423,783 | 2,457,273 | 2,127,929 |
| North Central | 159,476 | 155,584 | 190,551 | 173,083 |
| South Central | 32,674,904 | 31,971,445 | 31,149,162 | 32,177,081 |
| Atlantic | 4,351,744 | 4,203,419 | 3,113,811 | 2,712,111 |
|  | 69,461,119 | 68,392,390 | 67,435,495 | 68,028,196 |

[1] - Revised.

## DISCUSSION BY DISTRICTS

### California

Fuel oil supplied a somewhat greater proportion of the total fuel used by railroads in California in 1928 than in 1927. From 24,595,556 barrels in 1927 the total consumption of fuel oil by railroads in California rose to 24,616,364 barrels in 1928. Railroad purchases of fuel oil increased by 35,413 barrels, from 24,275,666 barrels in 1927 to 24,311,079 barrels in 1928. Stocks were reduced by only 305,285 barrels in 1928, as compared with the 319,890 barrels withdrawn from storage during 1927 and the 1,342,341 barrels transferred back from stocks to the oil companies from which the oil was purchased during 1927. Fuel oil burned by locomotives increased 60,964 barrels or 0.3 per cent, from 21,477,402 barrels in 1927 to 21,538,366 barrels in 1928.

Although the total ton-mileage of revenue freight carried by Class I railroads in California was 1.2 per cent larger in 1928 than in 1927 increased economy in the use of fuel and greater efficiency in operation permitted a reduction of 2.7 per cent in the total quantity of fuel burned in locomotives on these roads. Fuel oil, which constituted 71.7 per cent of the total tonnage of locomotive fuel burned on Class I railroads in the California district, in 1927 made up 73.9 per cent of the whole in 1928. Oil-burning locomotives in service on these railroads decreased 2.6 per cent in number, from 2,570 at the end of 1927 to 2,503 at the end of 1928, while coal-burning locomotives decreased 10.2 per cent from 647 at the end of 1927 to 581 at the end of 1928.

## Oregon-Washington district

An 8 per cent increase in revenue freight hauled by railroads operating in Washington and Oregon and by transcontinental lines terminating in those States led to an increase of nearly 5 per cent in the total consumption of fuel oil by those railroads. From 5,929,142 barrels in 1927 it rose to 6,221,628 barrels in 1928. Nearly half of the increase of 292,486 barrels was met by drafts on stocks held by the railroads; these decreased 26.4 per cent during the year, from 546,170 barrels on January 1 to 401,896 barrels on December 31, 1928. At the same time purchases of fuel oil increased 49,739 barrels, from 6,027,615 barrels in 1927 to 6,077,354 barrels in 1928. Moreover, all of the fuel oil purchased in 1928 was consumed during the year, whereas in 1927 fully 98,473 barrels had been added to oil held in storage. Locomotives burned 5,403,291 barrels or 91.1 per cent of the total consumption of fuel oil in 1927, and 5,691,590 barrels or 91.5 per cent of the total in 1928.

Because of greater economy and efficiency in the use of fuel the total tonnage of oil, coal, and firewood burned on Class I railroads to haul an 8 per cent larger ton-mileage of freight increased by only 2.0 per cent from 1927 to 1928. The locomotive consumption of fuel oil on Class I railroads, however, increased 4.9 per cent in the same period. In 1927 fuel oil constituted 13.0 per cent of the tonnage of all fuel burned in locomotives on Class I railroads in this district, but in 1928 it made up 13.3 per cent of the total. The number of oil-burning locomotives in service on these roads decreased 6.9 per cent, from 767 at the end of 1927 to 714 at the end of 1928, while the number of coal-burning locomotives decreased 4.0 per cent, from 4,377 at the end of 1927 to 4,204 at the end of 1928.

## Rocky Mountain District

Lower prices of coal may be considered instrumental in causing a 13.4 per cent decrease in the consumption of fuel oil by five Class I railroad systems operating in the Rocky Mountain States (other than transcontinental railroads terminating in Washington and Oregon). From 2,457,273 barrels in 1927 the quantity of fuel oil consumed by these railroads fell to 2,127,929 barrels in 1928. Their stocks of fuel oil increased 16,490 barrels or 16.4 per cent, from 100,322 barrels on January 1 to 116,812 barrels on December 31, 1928. Locomotives burned 2,102,895 barrels or 85.6 per cent of the total consumption in 1927 and 1,865,259 barrels or 87.65 per cent of the total in 1928.

Although revenue freight carried by these five Class I railroads increased 6.6 per cent the total consumption of fuel of all kinds increased only 1.6 per cent because of greater economy in the use of fuel. At the same time the locomotive consumption of fuel oil decreased 11.3 per cent. Fuel oil constituted 5.41 per cent of the tonnage of all fuel burned by locomotives in this district in 1927 but only 4.1 per cent in 1928. The number of oil-burning locomotives in service in this district decreased 7.5 per cent during 1928, from 320 on December 31, 1927, to 296 on December 31, 1928, while coal-burning locomotives decreased 5.6 per cent, from 4,920 on December 31, 1927, to 4,646, on December 31, 1928.

## North Central District

In the district lying north of St. Louis and Kansas City between the Appalachian

Mountains and the Missouri River the use of fuel oil in locomotives is incidental and unimportant; it constituted only 0.26 per cent of the total fuel burned by locomotives on Class I railroads in 1927 and only 0.07 per cent in 1928. Only two-fifths of the 190,551 barrels of fuel oil consumed in the North Central States district in 1927 and less than one-third of the 173,083 barrels consumed in 1928 were burned in locomotives. This oil, amounting to 77,873 barrels in 1927 and to 54,223 barrels in 1928, was used mainly to start fires quickly in coal-burning locomotives. No oil-burning locomotives were in service on Class I railroads within this district in 1927 or in 1928.

## South Central District

Lower prices, averaging 22.2 per cent less in 1928 than in 1927, increased the consumption of fuel oil by railroads of the South Central district by 1,027,919 barrels or 3.3 per cent over the figure for 1927. Railroads operating south of St. Louis and Kansas City, east of Albuquerque and Santa Fe, and west of Louisville, Nashville, and Montgomery, consumed altogether 31,149,162 barrels of fuel oil in 1927 and 32,177,081 barrels in 1928. Purchases increased 2 per cent, from 31,984,468 barrels in 1927 to 32,622,500 barrels in 1928. Stocks were increased by 445,419 barrels or 4.86 per cent, from 9,168,675 barrels on January 1 to 9,614,094 barrels on December 31, 1928. Locomotives burned 28,234,005 barrels or 90.6 per cent of the total consumption in 1927 and 30,002,239 barrels or 93.24 per cent of the total in 1928.

Whereas the ton-mileage of revenue freight carried on 15 principal oil-burning Class I railroads in this district decreased 16.52 per cent from 1927 to 1928 the total tonnage of all fuel burned in locomotives decreased 18.34 per cent. Through increased economy in the consumption of fuel and increased efficiency in the operation of locomotives the average quantity of fuel required to move ton of freight 1 mile on these railroads decreased 0.45 per cent from 1927 to 1928. Even greater economy was effected in the use of fuel oil; Data furnished by six Class I railroads of this district show that 2 to 6 per cent less oil was used to move 1,000 gross ton-miles of freight in 1928 than in 1927. An increase of 1.72 per cent in the locomotive consumption of fuel oil on these railroads was due primarily to a relatively greater use of fuel oil and a relatively lessened use of coal. Of the total fuel burned by locomotives, in the South Central district fuel oil constituted 30.81 per cent in 1927 and 33.16 per cent in 1928. Oil-burning locomotives in service on Class I roads in this district increased 5.7 per cent in number, from 3,468 on December 31, 1927, to 3,662 on December 31, 1928, while coal-burning locomotives decreased 4.5 per cent in number, from 5,932 on December 31, 1927, to 5,664 on December 31, 1928.

## Atlantic Coast District

Although the ton-mileage of revenue freight hauled by the seven principal oil-burning railroads terminating in the Atlantic States decreased 1.04 per cent from 1927 to 1928, the total consumption of locomotive fuel on these roads decreased 5.06 per cent and the locomotive consumption of fuel oil 21.1 per cent in the same period. However, fuel oil constituted only 0.60 per cent of the total locomotive fuel burned by Class I railroads in this district in 1927 and only 0.46 per cent in 1928. It is evident that any increase or decrease in the consumption of fuel oil in the Atlantic district depends not so much on general conditions as on the individual circumstances of the six railroad systems that together consume nine-tenths of the fuel oil used on railroads terminating on the Atlantic seaboard.

A drop of more than one-third in the ton-mileage of revenue freight and of 7.2 per cent in revenue passenger car-mileage on the largest consumer of fuel oil in the Atlantic States reduced its consumption of fuel oil by 22.2 per cent, and was the chief cause of the decrease of 401,700 barrels in the fuel oil consumed by all oil-burning railroads of the eastern seaboard. From 3,113,811 barrels in 1927 their total consumption in 1928 dropped 12.9 per cent, to 2,712,111 barrels. Of these totals only 1,399,145 barrels or 44.9 per cent in 1927 and 1,091,438 barrels or 40.2 per cent in 1928 was burned as locomotive fuel or for starting fires in coal-burning locomotives. Three-fifths of the entire amount was used in 1928 in railway shops for operating and starting fires in furnaces and forges, for burning weeds off the right of way, for preserving ties, and for various purposes other than fueling locomotives. Only 296 oil-burning locomotives were in service on Class I railroads in the Atlantic States on December 31, 1927 and only 297 on December 31, 1928. On the other hand 29,461 coal-burning locomotives were in service on Class I railroads in this district on December 31, 1927, and 28,477 on December 31, 1928.

## LOCOMOTIVE CONSUMPTION

Seven-eighths of all fuel oil consumed by railroads in the United States is burned directly as fuel in the operation of steam locomotives. Of the total national consumption 58,694,611 barrels or 85.3 per cent was burned by locomotives in 1927 and 60,243,115 barrels or 88.6 per cent in 1928. The proportion of the total consumption used in locomotives varies with the section of the country. In the Oregon-Washington district and in the South Central district more than nine-tenths of the whole is burned in locomotives. In California the proportion averages about seven-eighths, and in the Rocky Mountain district about six-sevenths. On the other hand, the ratio in the Atlantic States is only about two-fifths and in the North Central district from two-fifths to less than one-third.

Fuel Oil Consumed By Locomotives, 1926-1928
(In barrels of 42 U.S. gallons)

| District | 1926 | 1927 | 1928 |
|---|---|---|---|
| California | 21,385,033 | 21,477,402 | 21,538,366 |
| Oregon-Washington | 5,258,708 | 5,403,291 | 5,691,590 |
| Rocky Mountain | 2,056,504 | 2,102,895 | 1,865,259 |
| North Central | 45,857 | 77,873 | 54,223 |
| South Central | 28,277,519 | 28,234,005 | 30,002,239 |
| Atlantic | 2,306,069 | 1,399,145 | 1,091,438 |
| Total............ | 59,329,690 | 58,694,611 | 60,243,115 |

From 15,577,670 barrels in 1906 the consumption of oil as a locomotive fuel has grown in 22 years to an amount nearly four times as large. Although complete statistics of fuel oil burned by railroads before 1925 are not available the Interstate Commerce Commission has compiled and published figures for a number of years showing the quantity of fuel oil burned in locomotives operated by Class I railroads. This quantity represented in 1928 about 87 per cent of the total oil consumed as railroad fuel, the remainder being burned in shops, power plants, and vessels and in locomotives operated by Class II and Class III railroads. With these figures is a statement of the number of oil-burning locomotives in service on Class I railroads.

Fuel Oil Consumed by Locomotives (Class I Railroads Only

| Year | Oil-Burning Locomotives in Service[1] | Barrels of Oil Consumed[2] |
|---|---|---|
| 1908 | 2,354 | 16,889,100 |
| 1909 | 2,690 | 19,905,335 |
| 1910 | 2,981 | 23,817,346 |
| 1911 | 3,565 | 29,748,845 |
| 1912 | 4,052 | 33,605,598 |
| 1913 | 4,055 | 33,004,815 |
| 1914 | 4,140 | 31,093,266 |
| 1915 | 3/ | 32,830,187 |
| 1916 | 3/ | 38,208,516 |
| 1917 | 3/ | 42,973,555 |
| 1918 | 3/ | 39,022,785 |
| 1919 | 3/ | 37,763,361 |
| 1920 | 3/ | 45,944,539 |
| 1921 | 3/ | 39,558,181 |
| 1922 | 3/ | 43,526,787 |
| 1923 | 6,962 | 55,580,138 |
| 1924 | 7,373 | 58,949,918 |
| 1925 | 7,112 | 58,519,685 |
| 1926 | 7,304 | 58,563,755 |
| 1927 | 7,421 | 57,781,302 |
| 1928 | 7,472 | 59,402,680 |

1/ - Number available for service at the end of each year.

2/ - Annual reports, Interstate Commerce Commission.

3/ - Not available.

Nearly one-half of the oil-burning locomotives in service in the United States are operated in the South Central District and more than one-third in California. One-tenth are in service in the Oregon-Washington district. Only one-twenty-fifth are employed by railroads of the Rocky Mountain districts and a like proportion by railroads terminating on the Atlantic Coast.

Number of Oil-Burning Locomotives Available For Service on Class I railroads in the United States, Dec. 31, 1926-1928

| District | 1926 | 1927 | 1928 |
|---|---|---|---|
| California | 2,562 | 2,570 | 2,503 |
| Oregon-Washington | 761 | 767 | 714 |
| Rocky Mountain | 338 | 320 | 296 |
| North Central | - | - | - |
| South Central | 3,343 | 3,468 | 3,662 |
| Atlantic | 300 | 296 | 297 |
| | 7,304 | 7,421 | 7,472 |

Although the locomotive consumption of fuel oil varies in different sections with the volume of traffic hauled, the relative prices and availability of oil and coal, and efforts at increased economy, as well as purely local conditions, the national consumption of fuel oil by locomotives since 1920 has shown a general tendency to increase both in quantity and in relative importance.

In 1928 the proportion of fuel oil burned by Class I railroads to the total tonnage of fuel of all kinds consumed 11.45 per cent exceeded the maximum of 10.87 per cent attained in 1924 and in 1927. In the following table the fuel oil consumed has been converted, at the ratio used by most railroads (168 gallons to a short ton), to the number of short tons (2,000 pounds) of bituminous coal that theoretically represent an equivalent heating value, without considering the relative operating efficiencies of the various fuels consumed.

Comparison of Oil With Other Fuels Consumed (Class I Railroads Only

| Year | Fuel oil converted to fuel equivalent in short tons of bituminous coal | Total short tons of fuel consumed by locomotives | Per cent oil to total fuel consumed |
|---|---|---|---|
| 1917 | 10,743,389 | 150,230,647 | 7.15 |
| 1918 | 9,755,696 | 148,122,435 | 6.58 |
| 1919 | 9,440,840 | 132,620,935 | 7.12 |
| 1920 | 11,486,135 | 151,405,712 | 7.58 |
| 1921 | 9,889,545 | 121,006,242 | 8.17 |
| 1922 | 10,881,697 | 127,213,343 | 8.55 |
| 1923 | 13,895,034 | 148,921,714 | 9.32 |
| 1924 | 14,737,480 | 135,617,320 | 10.87 |
| 1925 | 14,629,921 | 135,419,983 | 10.80 |
| 1926 | 14,640,939 | 140,425,844 | 10.43 |
| 1927 | 14,445,326 | 132,945,460 | 10.87 |
| 1928 | 14,850,670 | 129,744,541 | 11.45 |

The relative importance of fuel oil as locomotive fuel varies considerably in the different sections of the United States. In the California district fuel oil constitutes nearly three-fourths of the total fuel burned in locomotives and in the South Central States nearly one-third. On the other hand, it makes up less than one-seventh of the locomotive fuel on railroads terminating in Oregon and Washington and only one-eighth of the locomotive fuel in the Rocky Mountain States. In the North Central States and in the Atlantic district, except on one railroad system, it furnishes less than 1 per cent of the fuel burned under locomotive boilers.

## FUEL ECONOMY

Since the World War special efforts have been made by the railroads of the United States to effect economy in the use of fuel, one of the chief items of operating cost. By the use of more powerful locomotives equipped with improved mechanical devices, by increasing the length of locomotive runs, by better loading of freight cars, by reducing track grades and sharp curves, by remote control of switches, by better facilities for fueling, and especially by enlisting the cooperation of employees the railroads have reduced the total consumption of fuel in locomotives from 173 pounds[3] per thousand gross ton-miles[4] in 1920 to 127 pounds[5] in 1928. Statistics furnished by several of the larger railroad consumers of fuel oil show that this tendency to economy in the use of fuel has been applied to fuel oil. For example, the Southern Pacific Lines in California estimate that 168,168 barrels of fuel oil in freight service and 28,410 barrels in passenger service were saved in 1928 by its campaign of fuel economy. The savings of fuel oil effected on the Southern Pacific lines both in the Pacific States and in Texas and Louisiana since 1912 are illustrated by the following table:

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3 - Bureau of Railway Economics, Washington, D. C.

4 - The term gross ton-miles includes the total weight in short tons of freight, cars, fuel and water, locomotive and tender, multiplied by the number of miles hauled.

5 - Interstate Commerce Commission.

| Year | Pacific coast lines Southern Pacific gallons of oil per— | | Southern Pacific lines in Texas and Louisiana, gallons of oil per— | |
|---|---|---|---|---|
| | 1,000 gross ton-miles[1] of freight | Passenger car mile | 1,000 gross ton-miles[1] of freight | Passenger car mile |
| 1912 | 16.63 | 1.37 | —— | —— |
| 1913 | 15.96 | 1.27 | —— | —— |
| 1914 | 15.50 | 1.20 | —— | —— |
| 1915 | 14.62 | 1.21 | —— | —— |
| 1916 | 14.56 | 1.22 | —— | —— |
| 1917 | 14.61 | 1.19 | —— | —— |
| 1918 | 14.18 | 1.18 | —— | —— |
| 1919 | 13.16 | 1.10 | —— | —— |
| 1920 | 14.42 | 1.11 | 11.71 | 1.17 |
| 1921 | 13.10 | 1.09 | 11.63 | 1.09 |
| 1922 | 12.85 | 1.06 | 11.35 | 1.07 |
| 1923 | 12.42 | 1.05 | 10.85 | 1.05 |
| 1924 | 11.47 | 1.00 | 10.22 | .95 |
| 1925 | 11.15 | .99 | 10.53 | .93 |
| 1926 | 11.94 | .945 | 10.38 | .88 |
| 1927 | 11.56 | .954 | 9.71 | .84 |
| 1928 | 11.28 | .950 | 9.25 | .82 |

[1] - The term gross ton-miles includes the total weight in short tons of freight, cars, fuel and water locomotive and tender, multiplied by the number of miles hauled.

Led by the advancing price of fuel oil the Texas and Pacific Railroad began in 1922 an intensive campaign of fuel economy. By purchasing and using more powerful modern locomotives and by obtaining the cooperation of employees through an educational campaign and through a system of contests and rewards the Texas & Pacific Railroad estimates that from 1922 to 1928, inclusive, it saved 4,132 carloads or about 983,000 barrels of fuel oil that otherwise would have been consumed. This is illustrated by the following tables:

Texas & Pacific Railroad;
Average Gallons of Fuel Oil Consumed per 1,000 Gross Ton-Miles
(Freight and Passenger Service) and per Switch-Engine Mile

| | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|---|---|---|
| Passenger service | 21.9 | 21.1 | 18.9 | 17.4 | 15.6 | 14.9 | 15.2 |
| Freight service | 14.9 | 14.2 | 13.3 | 12.1 | 10.7 | 10.4 | 9.8 |
| Switching service | 11.8 | 11.5 | 11.3 | 10.4 | 10.4 | 10.7 | 10.6 |
| Cars of fuel oil estimated to have been saved by decrease in unit fuel consumption | | | | | | | |
| Passenger service | | 108 | 308 | 211 | 259 | 101 | -72 |
| Freight service | | 294 | 434 | 645 | 793 | 218 | 648 |
| Switching service | | 40 | 29 | 140 | —— | -48 | 21 |
| | | 442 | 771 | 9961,052 | | 271 | 600 |

Economies in the consumption of fuel oil effected by other railroad systems are shown in the following table:

Gallons of Fuel Oil Consumed per 1,000 Gross Ton-Miles in Freight Service

| | 1926 | 1927 | 1928 |
|---|---|---|---|
| Gulf, Colorado & Santa Fe | 8.3 | 8.0 | 7.5 |
| Missouri-Kansas-Texas Lines | 9.0 | 8.7 | 8.6 |
| Missouri Pacific | 10.8 | 10.75 | 10.5 |

## VARIOUS USES OF FUEL OIL BY RAILROADS

About one-eighth of the total quantity of fuel oil consumed by railroads is used outside of locomotive fireboxes. Much of this is burned in repair shops, machine shops, boiler shops, and foundries as fuel for stationary engines, spring furnaces, forges, power plants, lathes, and other mechanical equipment. A large part is consumed as fuel on ferryboats, tugboats, lighters, and other marine equipment operated by the railroads. Considerable amounts are employed, especially in the northeastern quarter of the United States, to start fires in coal-burning locomotives. Miscellaneous uses include saturating crossties and timbers to preserve them from decay, oiling roadbeds to lay dust, burning weeds and grass off the right of way, operating snowplows, operating ovens in a commissary bakery, and heating office buildings.

Less fuel oil tends to be consumed each year by railroads in miscellaneous uses. The quantity consumed outside locomotive fireboxes decreased 10.9 per cent, from 8,740,884 barrels in 1927 to 7,785,081 barrels in 1928. On an average, about one-third of this oil is consumed in California, one-third in the South Central district, and one-fifth in the Atlantic States.

Fuel Oil Consumed by Railroads
Elsewhere Than in Locomotives, 1926-1928
(In barrels of 42 U. S. gallons)

| District | 1926 | 1927 | 1928 |
|---|---|---|---|
| California | 2,657,308 | 3,118,154 | 3,077,998 |
| Oregon-Washington | 337,110 | 525,851 | 530,038 |
| Rocky Mountain | 367,279 | 354,378 | 262,670 |
| North Central | 109,727 | 112,678 | 118,860 |
| South Central | 3,693,926 | 2,915,157 | 2,174,842 |
| Atlantic | 1,897,350 | 1,714,666 | 1,620,673 |
| Total | 9,062,700 | 8,740,884 | 7,785,081 |

## OIL-ELECTRIC LOCOMOTIVES

From the standpoint of fuel-oil consumption the employment of oil-electric locomotives on United States railroads is still relatively unimportant. At the end of 1926 there were 9 oil-electric locomotives in service on Class I railroads; 13 at the end of 1927; and 20 at the end of 1928. One more was delivered in March, 1929, and 5 more were being built during the first half of 1929. With but two exceptions the oil-electric locomotives in service in 1928 were used by the railroads only in switching service. These locomotives consumed 4,570 barrels of Diesel oil in 1927, and 7,662 barrels in 1928.

Since 1925, 14 other oil-electric locomotives have been placed in switching service at various manufacturing plants and industrial enterprises distributed widely over the United States; and 2 others on a minor railroad. No data on their consumption of oil fuel are at hand, but this may be estimated at about 4,000 barrels in 1928.